EETF Quarterly Progress Report

Grant # 7310029

Safe and Efficient Exhaust Thimble

Submitted by:

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Period: October 1, 2013 – December 31, 2013 (Q4)

Summary

The project Budget/Milestone Schedule from the Grantee's original scope of work is shown below. No changes to this scope have been made or requested.

Milestone	Task		Start Date	End Date	Grant Funds	Match Funds	Total Budget	Deliverables
	1	Purchase and assembly of DAQ and instrumentation	Feb 2013	Feb 2013	$12,196		$12,196	DAQ system "dry-run" data set to ACEP for plan verification
	2	High fidelity performance test of 2-inch thimble	Mar 2013	Mar 2013	$11,193	$5793	$16,986	Performance test results
MS 1: AEA accepts performance test results								
	3	Design, construct and testing of 4, 6, 8, and 10-inch thimbles	Apr 2013	Oct 2013	$62,868		$62,868	Performance test results
	4	Draft project report	Nov 2013	Dec 2013	$816		$816	Draft project report
	5	Final project report	Dec 2013	Jan 2014	$816		$816	Final project report
MS 2: AEA accepts final report								
Total					$87889	$5793	$93,682	

Deliverables Submitted

Task 1 and task 2 are complete. Work during this review period was primarily on task 3. Four new thimbles have been designed and constructed, and testing on one of the four has commenced.

Budget

Total funds expended to date are $12,541 of the grant total $87,889.00 (~14%). Primary expenditures during this quarter are personnel services (salary) during completion of task 2 and commencement of task 3. The project is currently running at 30% of projected budget in terms of percent completion of each task at this point, based on 10% completion of Task 3.

Schedule Status

Tasks 1 and 2 are complete, and Task 3 is approximately 10% complete. The four additional thimbles in task 3 have been designed and constructed. The first of these new thimble designs has been installed and a preliminary "dry-run" test was completed. Most labor has been refocused to one undergraduate and one graduate research assistant, while the project PI and other senior personnel are functioning as direct supervisors.

Percent Complete

The estimated percent completion of the 5 project tasks is shown in the table below.

Task 1: 100%	Task 2: 100%	Task 3: 1 0%	Task 4: 0%	Task 5: 0%

Task 1, *Purchase and assembly of DAQ and instrumentation*, is complete. This task was under budget because several pieces of equipment were obtained through surplus from previous university projects. This includes the data collection computer, A/D hardware box from National Instruments, and several non-grounded thermocouples. A pitot tube manometer was acquired in Q4 of 2014 to replace the hot wire anemometer that was not able to measure the high temperature flow rate (out of calibration at elevated temperatures).

Task 2, *High fidelity performance test of thimble*, is about 100% complete. Reproducible temperature data are being collected from 9 different locations on the thimble, and 24 different tests were completed. Work during Q3 and Q4 confirmed that air flow through the cooling channel is very irregular. Temperature monitoring at several radially distributed locations is necessary for a complete picture of the function even at steady state.

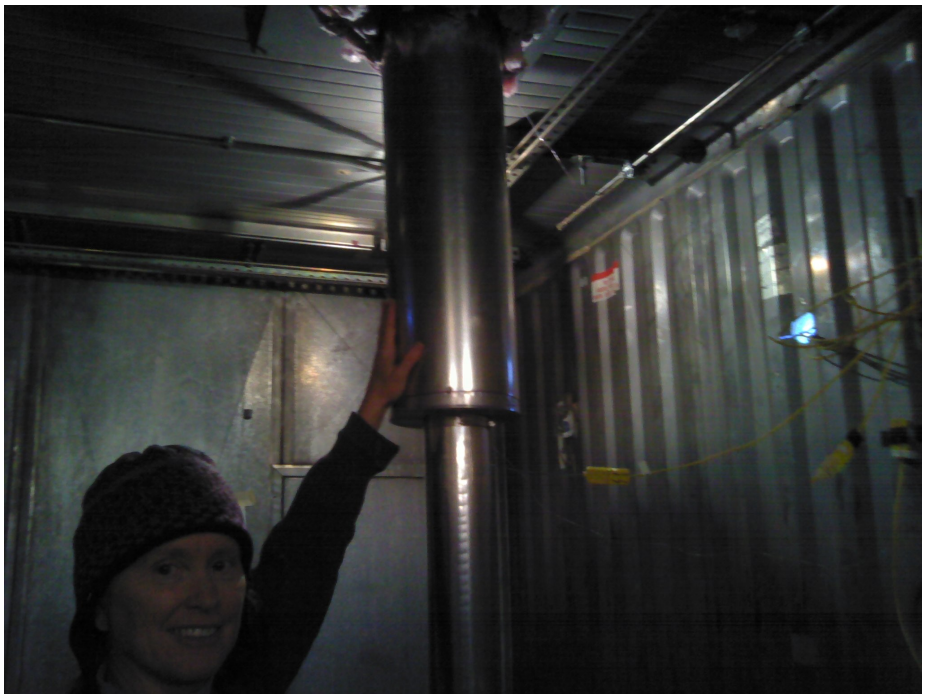
Task 3, *Design and Construction of Four New Thimbles*, is approximately 10% complete. All four of the thimbles have been designed and constructed, and the first has been installed and verified to function as expected. The digital manometer acquired during this period has been installed and verified to work at elevated temperatures, but the ideal location for the instrument is still being investigated.

Work Progress

The most recent thimble design that was installed is now being tested, and preliminary qualitative results are very encouraging. The following figures show a visual and IR photograph of the thimble during operation. The person shown has their hand a few inches above the hot exhaust at the bend in the thimble vent (not shown), and it is clearly cool to the touch. The FLIR image also clearly shows the difference in temperature between the exhaust and the thimble itself.

The digital manometer has been installed on the vent to measure air flow. It has been verified to work at the elevated temperatures, but the ideal positioning is still being investigated. The air flow through the vent his highly irregular, and we are investigating whether it is possible to correlate thermocouple temperatures with the air flow measurements, which would alleviate any need to purchase several manometers to be installed at various radial positions.

The project was originally scheduled to be completed on January 31, 2014. A no-cost extension for an additional six months was requested in order to complete the project since many unforeseen setbacks were encountered. The project is current under-budget, which is anticipated to continue even if the extension is granted.



Operator touching the thimble a few inches above the hot exhaust during operation

FLIR image showing operator touching the base of the thimble with bare hand during operation. Hot exhaust pipe is shown inches below.

Future Work

The next quarter future work, and expected outcomes, are the following in sequential order:

- Continue work on Task 3, specifically test 2 of the 4 new thimble designs
- Perform a quantitative comparison between the current numerical model and the thimble results from Task 2.